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AUTHOR Brinker, Richard P.
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ABSTRACT

The paper describes approaches used to assess preverbal or nonverbal orthopedically handicapped infants. The first section describes a conceptual approach to development that differs from the normative approach. The conceptual development model emphasizes developmental structures rather than successive cumulative acquisitions of behavior. This approach is merged with the "methode critique," which consists iof asking questions about the child's spontaneous modes of interaction with the environment. The combined approach is illustrated in a case study of a severely retarded 3-year-old boy with severe motor delays. Sensorimotor assessment of an infant with severe orthopedic handicaps is then considered, and a microcomputer is used to program consequences of behavior and provide ongoing behavior analysis. Alternative approaches to sensorimotor assessment are reviewed, and the importance of maintaining a broad ecological perspective in assessment is emphasized. (CL)

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Assessing Sensorimotor Functioning in Preschool Orthopedically Handicapped Children

Richard P. Brinker, Ph.D.

Institute for the Study of Exceptional Children

Educational Testing Service

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The purpose of this presentation will be to provide a general framework or attitude with which we conduct our assessment "conversations" with young orthopedically handicapped children. In twenty minutes it will not be possible to provide the necessary information on reflexology so that any one of you could normalize a spastic infant's muscle tone prior to your assessment. Nor will it be possible to provide sure-fire adaptations of each item in the Uzgiris-Hunt Ordinal Scales of Infant Development so that conceptually equivalent items can be presented with reduced motor requirements.

The attitude which I hope to convey is that in assessing a preverbal or nonverbal orthopedically handicapped infant we should begin with the behavioral repertoire which is typical for that child. We must find out how the infant spends most of his time at home and at school, the kinds of objects with which he interacts, and the situations in which his social responses differ. This characterization of the typical repertoire should then provide a hypothesis about the level of the child's development which can be tested by devising situations which capitalize upon the responses of which the child is capable.

Thus, the first part of my paper will illustrate a conceptual approach to development which is somewhat different from a normative approach. Subsequently, I will give some "tips" about things which might be considered in assessing the orthopedically handicapped infant who makes very little movement. For such infants there are no easy answers and my "tips" have worked maybe 50% of the time over the last 10 years. Thus, it is necessary to speculate about some of the technological innovations which might improve this success rate over the next few decades.

Over the last 10 years, the developmental model has gained increased acceptance both as a hypothesis about the nature of mental retardation and as a source of intervention goals. Simply stated, the developmental model of

retardation is that retarded children go through the same sequence of development but at a slower rate. Hence, the difference between mentally retarded children and nonretarded children is parallel to the difference between younger children and older children. Within the developmental model, the purpose of intervention is to accelerate the rate of development by selecting goals which are slightly more advanced than the current abilities of the child.

Although earlier attempts to accelerate development involved sequential curriculum goals (Ball, 1971; Montessori, 1964), it is only in the last decade that such goals were sought systematically from the research on the development of normal children. The developmental model emerged as a reaction to wholesale adoption (in America) of behavior modification as the primary basis for special education. The techniques of behavior modification applied well to situations in which readily apparent forms of behavior needed to be reduced in frequency or eliminated from a repertoire entirely. However, the selection of behavioral goals which needed to be established in a limited repertoire remained an arbitrary exercise which was outside the scope of behavior modification techniques. Bricker (1970) cogently argued that behavior modification would remain an "art form" until some objective basis was provided for selecting behavioral targets and sequences of behavioral targets. Developmental psychology was an obvious source which might provide the logical and empirical basis for selecting educational goals for young children (Filler, Robinson, Vincent-Smith, Bricker, & Bricker, 1975).

However, the types of educational models which can be drawn from developmental psychology can be quite diverse. The label "developmental model" can be very misleading when used as the basis for curricula primarily because there is such variety in the developmental information underlying such models. An

attempt will be made to clarify the nature of two types of educational models: normative and conceptual models. These two types of developmental models lead to very different educational practices. Thus, we have found that the information that a program is "developmentally based" provides very little clue about the nature of the program since the program could be based upon either a conceptual or a normative developmental model.

Normative and Conceptual Developmental Models

Current practice in the field of preschool special education simultaneously adopts two main orientations from developmental psychology. The first orientation is conceptual. From this perspective, the major emphasis is to demonstrate an overall lawful directionality in development based upon general universal processes (Piaget & Inhelder, 1969). This orientation generally de-emphasizes both the situation in which a response occurs and the context-specific response itself (Bower, 1979; Mounoud, 1977). Both the structure of the context and the type of response are considered as necessary but insufficient supports of the developmental phenomena.

The second orientation might be called a normative developmental model (Hogg, 1975; Switzky, Rotatori, Miller, & Freagon, 1979). The normative developmental model could be characterized as an attempt to provide detailed normative descriptions of behavioral progress leading the child from simple forms of behavior to complex adult performance. The normative approach can be used to multiply and refine indefinitely minute sequences of development in an unlimited number of curriculum domains or performance situations.

The application of either the conceptual or the normative model of development to curricula for handicapped children rests on the assumption that normal

and handicapped children develop through the same general processes. On the one hand, the normative approach focuses upon the average age at which specific behaviors are acquired by normal children. The normative approach emphasizes the objectivity of behavioral description and the standardization of the conditions under which a specific behavior should be observed. On the other hand, the conceptual approach focuses upon larger classes of behavior with the assumption that a wide variety of different instances of behavior share the same structural properties which define that class of behavior. The shifting rules of class definition throughout development constitutes the major feature of developmental stages. The bases for the normative and conceptual developmental models will be examined below.

The Normative Developmental Model

The normative developmental model relates the performance of a specific child to a norm derived from the performance of a large number of children. Specific curricula based upon a normative developmental model usually have organized items from standardized developmental tests into curriculum domains such as fine motor skills, gross motor skills, communication skills, self help skills (Cohen & Gross, 1979; Forsberg, Neisworth, Laub, 1977; Shearer, Billingsley, Frohman, Hilliard, Johnson, & Shearer, 1972; Wabash Center, 1977; White, Edgar, Haring, Affleck, & Hayden, 1978). Such curricula offer teachers thousands of behavioral targets from which to construct an educational program for a child. The basic process is to test the child on the specific behavioral items, to determine items which the child cannot perform and to teach the child those behaviors.

The major problem with a normative developmental approach can be discovered by reviewing the process and theory of normative test construction. The purpose of a standardized test is to compare an individual's overall performance to the performance of the standardization group. The only valid conclusion permissible within the normative approach is a conclusion regarding the comparability of a child to the standardization group in terms of total or subtotal scores rather than comparability in terms of specific behaviors on test items. The question of whether specific performance on items selected from normative instruments has any relevance to developmental curricula requires a philosophical speculation which is completely outside the framework in which these performances were meant to have any validity.

Thus, the normative hierarchy of behavior is not organized along any clear conceptual lines. For example, item 73 on the Bayley Scale of Infant Development (Bayley, 1969) is "lifts cup with handle." The average age at which children from the standardization group emitted this behavior under controlled testing conditions was 5.8 months. Four months later children generally pass item 92 "stirs with spoon in imitation." No attempt is made within the normative developmental framework to conceptualize the difference in behavior of picking up a cup by the handle versus imitating stirring in a cup with a spoon. Is this a development in the use of a cup, a development in the understanding of objects and their relationships, or developments in completely different domains of behavior, e.g., imitation versus fine motor skills? While these questions are totally irrelevant to the psychometrician (who could have just as easily constructed items not involving cups), these questions are important to the educator. Unfortunately, the specific behavioral items are being included as curriculum items in spite of the fact that they are trivial in both the psychometric and educational senses.

Conceptual Developmental Models

A conceptual development model emphasizes developmental structures rather than successive cumulative acquisitions of behavior. Structures and their functioning mechanisms are inferred on the basis of the child's spontaneous interactions either in his natural environment (Chatelanat & Schoggen, 1980) or in specially designed situations which leave room for the child's initiative and spontaneity (Uzgiris & Hunt, 1975). Normative statements are rejected in favor of hypotheses regarding the underlying processes of mental organization. Concepts underlying behavior in several domains form the basis for a developmental hierarchy. In order to characterize the mental organization of a child, it is just as necessary to understand the relationships among concepts in different domains as it is to understand the development within a domain.

Unfortunately, a theoretical framework such as Piaget's theory (Piaget, 1970) does not provide a ready made functional model for intervention. It does not provide step by step sequences which map the child's progression from simple to more complex levels of functioning. It does not generate normative statements about fine-grained changes of behavior. It cannot provide the educator with readily available knowledge about variations in developmental patterns or rhythms as they may occur in individual children in specific environments. Consequently, the attempt to reformulate or supplement a model such as precision teaching with Piaget's Theory would be an arbitrary and inappropriate exercise.

However, a conceptual developmental model such as Piaget's can provide a new canvas of an overall developmental picture in which elements (or sequences of elements) previously described and taught in isolation could be seen as being interrelated. Thus, the individual behaviors often separately targeted

within the litany of gross motor, fine motor, language and self help skills acquire a new significance as critical components of a mental construction process. In addition, research methods, in particular Piaget's "methode clinique" or "methode critique" might provide us with a still underestimated instrument to forge our own knowledge about the next most probable step for a child in a given developmental or learning sequence. In addition, the "methode critique" can provide the basis for selecting materials and tasks to facilitate the child's learning process. Bricker (1976) has proposed a similar method, strong inference (Platt, 1964), for generating new knowledge and intervention strategies in special education.

The "method critique." The "method critique" (Vinh-Bang, 1966) consists essentially in asking questions about the child's spontaneous modes of interaction with his environment. Through observation of those interactions one can generate hypotheses about the general mental organization underlying the child's action patterns (Chatelanat & Schoggen, 1980). By selecting objects and situations (and their possible variations) and observing the child's subsequent adjustments and explorations, those hypotheses can be tested and lead to inferences about his level of cognitive development. This is quite different from asking the child to demonstrate preestablished forms of behavior and making statements about their presence or absence. Rather, the "methode critique" in the context of a conceptual developmental model would lead to assessments and intervention strategies which capitalize on the handicapped child's competencies and areas of strength rather than on his weaknesses and absence of acquisitions. Perhaps the best way to illustrate the "methode critique" which is a dynamic assessment process is to provide an example.

Applying the "methode critique" and the conceptual developmental model

An example in which a conceptual developmental model was used in the analysis and modification of the behavior of a severely retarded three-year-old boy with severe delays in motor development was presented by Brinker and Bricker (1973), Filler and Smith (1973) and Chatelanat. The information from these analyses was used to plan an educational program for the child. The child had a very limited behavioral repertoire in the classroom. His major activity consisted of flipping and spinning plastic figures on a playpen. When left on his own he would gladly spend the full 2 1/2 hour session engaged in this activity. Occasionally he would emit a monosyllabic vowel sound "ah" or he would grind his teeth.

Since flipping seemed neither to be the kind of skill which should be perfected nor a skill which served any clear function the question was whether we should attempt to eliminate it from this child's repertoire. Flipping seemed to compete with most other behaviors which had been selected as educational objectives. However, from the perspective of the conceptual developmental model, this behavior should provide assessment information on the child's level of cognitive functioning. Whereas flipping objects does not appear on any normative developmental checklists known to the authors, it apparently served some function for this child or he would not have persisted in it. From the Piagetian perspective, flipping would be an example of a simple object scheme which served the child as a means of classifying objects.

We found that the child's limited repertoire functioned in an orderly and predictable way given certain contextual features. Social contexts produced more vocalization while the physical context influenced the amount of flipping.

For example, if the crib figures were taped down so that they did not bounce on their springs then the flipping was reduced. If a person was next to the child, then vocalizations increased and flipping decreased. These kinds of experimental manipulations led to the conclusion that for this child flipping served to differentiate environmental features rather than being a simple stereotyped behavior impervious to contexts.

Filler and Smith (1973) demonstrated that not only was the child sensitive to the context when engaged in flipping, he also appeared to use flipping to classify objects. They selected objects on the basis of their physical properties as being conducive or not conducive to flipping. The child clearly spent more time in contact with objects which could easily be flipped (e.g., a queen bee with spring antenna) when given such objects along with less "flippable" objects (e.g., squeaky pig). Moreover, his performance on an adapted version of the Uzgiris-Hunt (1966) Scales (Robinson & Robinson, 1978) of object permanence, spatial relations, and means-ends indicated wide variations depending upon whether "flippable" or "non-flippable" objects were used. Performance was as much as two levels higher in these sensorimotor domains.

The initial observations of the child's limited behavioral repertoire led to hypotheses tested in the mini-experiments which informed the overall assessment of this child's developmental level. This critical method not only gave us a new understanding of the meaning of "flipping" for this child, it also enabled us to use this understanding to select objects for the structured sensorimotor assessment procedure. The overall picture of the child which emerged led Chatelanat, in conjunction with the classroom teachers, to devise a series of learning situations to teach other developmentally important skills.

For instance, the child was encouraged to use both hands rather than only the right hand by presenting him with objects which had to be held or positioned with one hand while flipping. For example, holding a car in one hand while spinning its wheels eventually led him to hold and push a toy car. Flipping or spinning a metal object on a wooden or plastic surface produced a startling noise which seemed to interest him and made it possible to introduce games of dropping objects in containers and experimenting with different objects and surfaces. Dropping and spinning objects of different size, weight, shape, gradually taught him to adjust the position of his hands and fingers according to specific properties of objects. Skills in locomotion and balance were developed by placing objects which could be flipped or spun on a shelf or a low table to which the child could pull up easily and lean against while playing. Objects placed out of immediate reach would be retrieved first by adjusting the body position (leaning over, stretching the arms), later by crawling, scooting, walking along the shelf or table. Understanding of means-ends relationships was facilitated by presenting, out of reach, preferred objects which could be retrieved by pulling an attached string or moving the support on which the object was placed or had fallen.

The two major features of the above case study were that observation of the child's predominant behavior provided the basis for both assessment and program planning. First, the conceptual developmental model begins the assessment process by assuming that the best clue to a child's developmental level will be found by observing his "typical" interactions with people and the environment. Mini-experiments are then devised to test the adequacy of these observational assessments. Second, mini-experiments and the intervention are based upon slight transformations of the objects and context available when the child was observed.

Theoretical knowledge about general developmental processes was necessary to envision educational objectives such as the understanding that actions can be combined in sequence as means to a desired end. However, this theoretical knowledge had to "come alive" in those spontaneous activities of the specific child playing in his world with his favorite objects. Once we have identified the individual child's dominant modes of interaction, his particular interests, and his preferences then we can use our theoretical knowledge to plan and implement an integrative intervention which leaves as much as possible to the child's own initiative and spontaneous discoveries.

The Severely Orthopedically Handicapped Infant

In cases where the degree of motor impairment is such that there is no obvious "spontaneous interaction" with the environment then we are truly at a disadvantage. In such cases, sensorimotor assessment must involve a collaborative effort between psychologists, parents, teachers, physical and/or occupational therapists to obtain all information about the child's behavior. The initial goal of such collaboration is twofold: (1) to find some movement which occurs repeatedly and to discuss some method of stimulation to which there is a reaction. This pursuit requires knowing a physical position in which movement is possible, and ensuring that the infant remains in a behavioral state such that occurrences of stimulation can be noticed. In addition, the parameters of the object or stimulating event must be selected to avoid precipitation of startle reactions, seizures, or simply a fussing baby. Particular attention should be paid to the features of objects and events relative to any differential behaviors which the infant has exhibited relative to these objects, as in the "flipping" example discussed. Likewise, if the infant is locked into an

abnormal reflex pattern then voluntary movement will not be possible. Thus, a position must be determined in which the orthopedically handicapped infant's muscular tone is normalized to the maximum possible extent before any behavior is demanded of the infant.

Given that a potential movement has been identified, one needs to select a variety of events and determine if there is any difference in the rate or duration of movements given these events. While this is a conceptually simple conditioning task, it can become quite difficult, technically, (a) to harness the movement so that it is reliably registered, and (b) to arrange alternative kinds of consequences. To overcome these technical difficulties we have developed a contingency intervention system in which a microcomputer accepts response inputs from up to eight sources which the baby directly activates (e.g., kicking a panel) or from 16 sources which an observer could record. Durations of behavior as well as frequencies are derived by the microcomputer. A variety of consequences can be programmed and ongoing analysis of behavior enables the system to switch the types of consequences or the response requirements depending upon various preselected criteria.

The contingency intervention system has functioned as a behavioral microscope to help generate hypotheses about even very limited behavioral repertoires and to test these hypotheses longitudinally. For example, we are developing methods to determine whether a severely handicapped infant is functioning at the level of primary circular reactions (i.e., he tries very grossly to obtain repetitions of interesting events), or whether the infant is functioning at the level of secondary circular reactions (i.e., he uses specific procedures systematically to obtain a repetition of an event). Simple acceleration of behavior above baseline is sufficient to demonstrate that an infant produces

primary circular reactions. Such an acceleration indicates that there is some level of contingency awareness, that is, some concept "I can make things happen." However, in order to demonstrate that the infant is "trying" specifically to reproduce an event, it is necessary to demonstrate some systematic use of alternative responses or to identify a differential pattern of response. We have found that a multiple baseline design is nicely suited to detecting the difference between primary and secondary circular reactions. If one response is reinforced then the infant at the secondary circular reaction level will differentially increase the rate of that response while other responses will remain at the baseline level. The infant at the primary circular reaction level will increase the general rate of activity such that several motor responses may be accelerated in addition to the response which is actually reinforced.

An operant conditioning analysis can be integrated with Piagetian theory in the sensorimotor areas of developing flexible means to obtain an end and in the understanding of physical causality. However, this conditioning analysis does presume some movement.

In the future, the requirement of physical movement may be reduced if the technology for measurement of neural potential improves. Currently, experiments are underway with amputees, in which voluntary attempts to move phantom limbs can be measured and linked to a variety of consequences. Whether such well organized, discriminable neural responses from developmentally young orthopedically impaired children could be similarly related to consequences is unknown at this point.

A final approach to sensorimotor assessment of orthopedically impaired young children has been developed in Holland by Jan Van Dijk. The method,

"coactive movement," involves the physical prompting of required actions in a very repetitive fashion. The notion is that action "scripts" are passively established by physically guiding the child to do the same actions with specific objects in a fixed sequence. Thus a routine is established. For example, the child might be physically prompted to bang a hammer on a table, to mouth a rattle, and to throw a ball.

After the routine has been completed several times, probe trials are interspersed in which the adult waits for the child to initiate the movement. Initiating the movement which had been prompted would lead to the hypothesis that the child had learned that scheme for a specific object. By introducing new objects with selected characteristics, it would be possible to determine if the infant were able to identify objects in terms of differential use of action schemes which had been established through coactive movement. From this perspective, assessment would include the establishment of a routine and the systematic violation of that routine to determine if the infant had an expectancy about the behavior in the routine.

Finally, a method for assessing sensorimotor development could rely upon portrayal of relationships in purely figurative terms. This would involve depicting problem situations through the use of pictures and requiring a simple motor response (e.g., eye pointing) to select among the alternatives. The development of object permanence can be assessed in this way by having the infant look at the alternative under which he thinks the object is hidden.

In general, major communication breakthroughs with the orthopedically impaired have capitalized upon use of a simple response which has different meanings depending upon a complex stimulus array such as an alphabet or word board. The orthopedically handicapped person makes a response (e.g., hitting

on a switch) which results in a menu of alternatives and a cursor which automatically moves through the alternatives. When the response is made the stimulus upon which the cursor has stopped is then given as output to others.

The contingency intervention approach to assessment of physical causality or means-end behavior should really only be considered as a last resort if it clear that only a few simple motor movements are possible. Gounin-Decarie's (1969) research with thalidomide babies clearly indicates that a wide range of different motor actions involving the child's feet, or in one case, the child's nose, can provide evidence of simple object schemes. It is always preferable to base the sensorimotor assessments on physical contact with objects, if this is possible. We don't want to discourage a child from actively exploring an object or event because we have led him to believe that he lives in a remote control world. However, for the child who shows little movement, whose locomotion is severely restricted, both the conditioning and the coactive movement approaches offer some options for the assessment and teaching of basic sensorimotor functions.

While these specific techniques require some study in their own right, the key to assessing the severely orthopedically impaired preschooler is a broad ecological perspective. The job of "establishing rapport" requires extensive information about correct positioning, daily patterns of behavior, object familiarity, object preferences, and a significant investment of time. There is little hope of discovering the sensorimotor competence of a severely orthopedically handicapped preschooler without a clear understanding of the nature of the sensorimotor problems, apart from the specific materials and behaviors we may use in posing those problems.

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